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PATENT ABSTRACTS OF JAPAN

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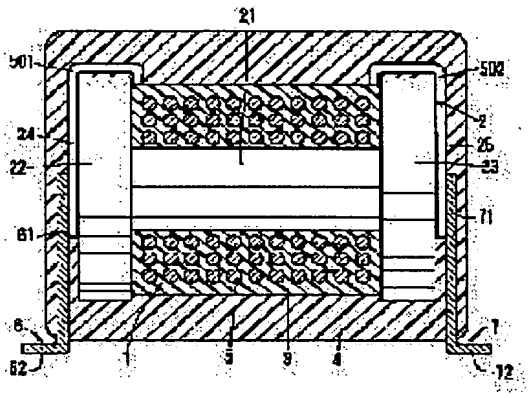
(71)Applicant : TDK CORP
(72)Inventor : HAYAKAWA TAKANORI
OKAZAKI KOICHIRO

(54) ELECTRONIC PART

(57)Abstract:
PROBLEM TO BE SOLVED: To shorten the time required to mold the package body of an electronic part so as to improve the productivity of the part by forming the winding section of the parts by winding a conductive wire around a support member and the layer insulator of the part by filling up the spaces between the conductor wires with a thermosetting insulating resin, and then, the package by molding an insulation resin so that the package can enclose the entire body of the part.
SOLUTION: The winding section 1 of an electronic part is formed by winding a conductive wire 5 around a support member 2. The member 2 of the part is composed of a core formed by molding a ferrite magnetic material, etc., and has a drum-like shape having flange sections 22 and 23 at both ends and a narrow intermediate section 21 between the flange sections 22 and 23. The conductive wire 5 is composed of a conductor coated with an insulation film. The insulation film of the conductor can be formed of polyurethane, etc. A layer insulator is made of a thermosetting insulating resin and fills up the gap formed of the wire 5. The package 4 of the part is made of a thermoplastic insulation resin and covers the entire body of the electronic parts.



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* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1] They are the electronic parts which it is electronic parts including the coil section, supporter material, the insulating material between lines, and a sheathing object, and said coil section loops said supporter material around an electric conduction line, and is constituted, the insulating material between said lines becomes by thermosetting insulation resin, the clearance produced between said electric conduction lines is filled, and said sheathing object became with the insulating resin molding object, and have covered the whole.
[Claim 2] They are the electronic parts which it is the electronic parts indicated by claim 1, and said sheathing object becomes by thermoplastic insulation resin.
[Claim 3] They are the electronic parts which are filling the clearance produced after the insulating material between said lines removes said covering of said outbound-track material by being the electronic parts indicated by claim 1 and said electric conduction line making the wire rod which has an insulating coat around an electric conduction core wire, and has covering removable [with chemical preparation] on said insulating coat outbound-track material.
[Claim 4] They are the electronic parts which it is the electronic parts indicated by claim 3, and said covering becomes with polyester.
[Claim 5] They are the electronic parts with which it is the electronic parts indicated by claim 1, and said supporter material contains a magnetic material.
[Claim 6] While being the approach of manufacturing electronic parts, looping around an electric conduction line on supporter material and having an insulating coat around an electric conduction core wire as said electric conduction line in that case What has covering removable [with chemical preparation] is used on said insulating coat. Next, the manufacture approach of the electronic parts which cast the sheathing object which thermosetting insulation resin is applied and infiltrated into the clearance produced after chemical preparation's removing said covering, next removing said covering, and is stiffened, next covers the whole using insulating resin.
[Claim 7] It is [Claim 8] which is the manufacture approach indicated by claim 6 and casts said sheathing object using thermoplastic insulation resin. It is the manufacture approach of electronic parts that are the manufacture approach indicated by claim 6 and said covering of said electric conduction line becomes with polyester.
[Claim 9] It is the manufacture approach of electronic parts that are the manufacture approach indicated by claim 6 and said supporter material contains a magnetic material.

[Translation done.]

* NOTICES *

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the electronic parts containing various coil systems, a transformer, etc., and its manufacture approach.
[0002]
[Description of the Prior Art] As for this conventional kind of electronic parts, it is common to take the structure which twisted the electric conduction line on supporter material, such as a core and a bobbin, and covered the whole with sheathing insulation resin as everyone knows. As an electric conduction line, it has an insulating coat around the electric conduction core wire which becomes with copper wire etc., and the wire rod which prepared the welding coat on the insulating coat is known. When the electric conduction line of this configuration is used, thermosetting insulation resin is used as sheathing insulation resin. Moreover, between the coil section which twisted and constituted the electric conduction line, and sheathing insulation resin, applying silicon resin is also known as an under coat layer used as a buffer coat.
[0003] As sheathing insulation resin, since thermosetting insulation resin is used for the trouble of the conventional electronic parts mentioned above, it is that the injection holding time and the setting time take long duration, and productivity does not go up in molding of sheathing insulation resin. The time amount which molding of thermosetting resin takes becomes about about 7 times of the time amount which molding of thermoplastics takes.
[0004] As a means to solve this problem, constituting sheathing insulation resin from thermoplastics has so far been examined. However, the molding temperature of thermoplastics becomes also for example, before and after about 360 degrees C. This means that about 250 degrees C becomes high to the molding temperature of thermosetting resin being around about 85 degrees C. And the molding pressure force of thermoplastics will also become 490 kgf/cm2, and will be about 20 times pressure 22 kgf/cm2 which molding of thermosetting resin takes. The high molding temperature and the high molding pressure force of thermoplastics give big stress to the electric conduction line which constitutes the coil section. destruction of the insulating coat in which the electric conduction line adhered to this stress, deformation of a conductor, an open circuit, or a conductor -- the short circuit of a between etc. has very serious effect on the coil section. Moreover, if the high molding pressure force is added, since an electric conduction line will be in the condition of being easy to move too much, a volume style changes and an inductance value is changed.
[0005] Although silicon resin was conventionally applied as an under coat layer used as a buffer coat between the coil section and a sheathing insulator, even if it has this under coat layer, when thermoplastics is used, sufficient stress relaxation operation for protection of the coil section cannot be acquired as sheathing insulation resin.
[0006] It has an insulating coat as an electric conduction line especially around the conductor which becomes with copper wire etc. on an insulating coat Since it will be in the condition of saying that a welding coat fuses for the high temperature at the time of casting thermoplastic insulation resin, and the high molding pressure force joins the melting condition when the wire rod which prepared the welding coat is used, destruction of the insulating coat to which the

electric conduction line adhered, deformation of a conductor, an open circuit, or a conductor -- it very becomes easy to produce accident, such as a short circuit of a between.
[0007]
[Problem(s) to be Solved by the Invention] The technical problem of this invention is offering the electronic parts which shortened the time amount which sheathing object molding takes, and raised productivity.
[0008] destruction of the insulating coat to which the electric conduction line adhered even if another technical problem of this invention applied a high pressure and temperature to electronic parts, and a conductor -- deformation of a core wire, an open circuit, or a conductor -- it is offering the electronic parts of the high-reliability which can prevent accident, such as a short circuit between core wires, certainly.
[0009] It is offering the electronic parts which can secure the inductance value of this invention further stabilized by another technical problem.
[0010]
[Means for Solving the Problem] In order to solve the technical problem mentioned above, the electronic parts concerning this invention include the coil section, supporter material, the insulating material between lines, and a sheathing object. Said coil section loops said supporter material around an electric conduction line, and is constituted. The insulating material between said lines becomes by thermosetting insulation resin, and the clearance produced between said electric conduction lines is filled. Said sheathing object becomes with the insulating resin molding object which covers the whole.
[0011] Since the coil section is covered with the insulating material between lines which becomes by thermosetting insulation resin, the electronic parts concerning this invention oppose the stress added from the outside, where the coil section and thermosetting insulation resin are unified. for this reason, destruction of the insulating coat to which the electric conduction line adhered as a sheathing object in the molding process performed on condition that high temperature and the high-pressure force even when thermoplastic insulation resin was used and a conductor -- deformation of a core wire, an open circuit, or a conductor -- the short circuit of a core wire etc. can be certainly prevented with the insulating material between lines which becomes by thermosetting insulation resin. Therefore, the whole electronic parts can be covered with the sheathing object which becomes by thermoplastic insulation resin.
[0012] Moreover, since the coil section is united with the insulating material between lines which consisted of thermosetting insulation resin, an electric conduction line does not move at the time of molding of a sheathing object. For this reason, a volume style is kept good and the stable inductance value can be secured.
[0013] When the whole electronic parts are cast with the sheathing object which becomes by thermoplastic insulation resin, the time amount which molding of thermoplastic insulation resin takes becomes remarkably short rather than the time amount which molding of thermosetting insulation resin takes, as mentioned above. Therefore, as a sheathing object, conventionally which used thermosetting insulation resin, as compared with elegance, the time amount which molding of a sheathing object takes can be shortened remarkably, and productivity can be raised by using thermoplastic insulation resin. What has the melting temperature which can fully bear it in consideration of the service temperature of the electronic parts concerned as thermoplastic insulation resin is used.
[0014] The manufacture approach concerning this invention for manufacturing the electronic parts mentioned above takes the following processes. First, an electric conduction line is looped around on supporter material. While having an insulating coat around an electric conduction core wire as said electric conduction line at this time, the wire rod which has covering removable [with chemical preparation] is used on said insulating coat. Next, chemical preparation removes said covering. Next, it applies, and the clearance produced after removing said covering is infiltrated, and is made to harden thermosetting insulation resin. Next, the sheathing object which covers the whole is cast using insulating resin. According to this manufacture approach, the electronic parts concerning this invention can be manufactured easily.
[0015] Other purposes, means, and advantages of this invention are explained in more detail with

reference to an example slack accompanying drawing. An example is not accompanied by limitation at all about the protection range of this invention.
[0016]
[Embodiment of the Invention] Drawing 1 is the fragmentary sectional view of the electronic parts concerning this invention. The electronic parts concerning this invention include the coil section 1, the supporter material 2, the insulating material 3 between lines, and the sheathing object 4. The coil section 1 loops the supporter material 2 around the electric conduction line 5, and is constituted. The supporter material 2 is a core, bobbins, or those combination, and can take the configuration and structure of arbitration. The supporter material 2 shown in an example is the core cast using the ferrite magnetic material etc., makes pars intermedia 21 thin and has the configuration of the shape of so-called drum where the flange sections 22 and 23 were formed in the both ends.
[0017] The thing of the structure which covered with the insulating coat the conductor with which the electric conduction line 5 turns into a core wire is used. There is polyurethane etc. as an example of an insulating coat. The terminal 501 of the electric conduction line 5 and 502 are connected to terminals 6 and 7 by means, such as soldering. Terminals 6 and 7 are being fixed to the interior of the sheathing object 4 while the upper parts 61 and 71 are arranged along with the skin of the flange sections 22 and 23 of the supporter material 2. The lower limit sections 62 and 72 of terminals 6 and 7 are led to the exterior of the sheathing object 4, and are used as a soldering part when surface mounting is carried out to the circuit board etc.
[0018] Polar zone 24 and 25 is formed in the side edge side of the flange sections 22 and 23 of the supporter material 2, and the terminal 501 of the electric conduction line 5, 502, and terminals 6 and 7 are soldered to electrode sections 24 and 25.
[0019] The insulating material 3 between lines becomes by thermosetting insulation resin, and the clearance produced between the electric conduction lines 5 is filled. As a desirable example of the thermosetting insulation resin which constitutes the insulating material 3 between lines, silicone acrylate insulation resin can be mentioned, for example. The clearance which made it generated intentionally besides the clearance which generates automatically the clearance produced between the electric conduction lines 5 in a coil process is also included. A means to generate a clearance intentionally is explained in detail in the example of the manufacture approach concerning this invention.
[0020] The sheathing object 4 became by thermoplastic insulation resin, and has covered the whole. As an example of the thermoplastic insulation resin which constitutes the sheathing object 4, EC301B (Nippon Oil Co., Ltd. make) which is a liquid crystal polymer can be mentioned. This thermoplastic insulation resin has high melting temperature, and is excellent in thermal resistance.
[0021] Since the coil section 1 is covered with the insulating material 3 between lines which becomes by thermosetting insulation resin as mentioned above, where the coil section and thermosetting insulation resin are unified, the stress added from the outside is opposed. for this reason, destruction of the insulating coat to which the electric conduction line 5 adhered as a sheathing object 4 in the thermoplastic insulation resin molding process performed on condition that high temperature and the high-pressure force even when thermoplastic insulation resin was used and a conductor -- deformation of a core wire, an open circuit, or a conductor -- the short circuit of a core wire etc. can be certainly prevented with the insulating material 3 between lines which becomes by thermosetting insulation resin. Therefore, as mentioned above, the whole electronic parts can be covered now with the sheathing object 4 which becomes by thermoplastic insulation resin.
[0022] And since the coil section 1 is united with the insulating material 3 between lines which becomes by thermosetting insulation resin, the electric conduction line 5 does not move at the time of molding of the sheathing object 4. For this reason, the volume style of the coil section 1 is kept good, and the stable inductance value can be secured.
[0023] Furthermore, the time amount which molding of thermoplastic insulation resin takes is about 1 of the time amount which molding of thermosetting insulation resin takes / about 7 times, as mentioned above. Therefore, as a sheathing object 4, conventionally which used

thermosetting insulation resin, as compared with elegance, the time amount which molding of the sheathing object 4 takes can be shortened to about about 1 / 7, and productivity can be raised by using thermoplastic insulation resin.
[0024] Next, the approach for manufacturing the electronic parts mentioned above with reference to drawing 2 - drawing 8 is explained.
[0025] <Coil process> First, as shown in drawing 2 , the electric conduction line 5 is looped around on the supporter material 2. As shown in drawing 3 , while having the insulating coat 52 around the electric conduction core wire 51 as an electric conduction line 5, the wire rod which has the welding coat 53 removable [with chemical preparation] is used on the insulating coat 52. The example of representation of the insulating coat 52 is polyurethane, and the example of representation of the welding coat 53 is polyester. The welding coat 53 may be called a self welding layer. Since it is good if removal by chemical preparation is possible for the welding coat 53, it does not necessarily need to be polyester. The following electric conduction lines 5 were used in the example.
2CW-N4E (Riken Electric Wire Co., Ltd. make)
wire-size: -- 0.03mm electric conduction core wire 51:lead-wire insulation coat 52: -- polyurethane welding coat of 2 micrometers of thickness 53: -- polyester of 2 micrometers of thickness Melting temperature [0026] of 90 degrees C In a <soldering process>, next drawing 2 , a leadframe 8 between the terminals 6-7 which started and were formed The supporter material 2 which looped around the electric conduction line 5 is carried, chestnut-MUHANDA is applied to the polar zone 24 and 25 formed in the side edge side of the flange sections 22 and 23 of the supporter material 2, and electrode sections 24 and 25, the terminal 501 of the electric conduction line 5 and 502, and terminals 6 and 7 are connected by soldering. Although illustration is omitted, along the die-length direction (it is perpendicularly to space), to said leadframe 8, the same terminals 6 and 7 separate spacing, and a large number formation is carried out at it.
[0027] A <washing process>, next chemical preparation remove said welding coat 53. For example, as shown in drawing 4 , penetrant removers, such as a methylene chloride, are showered over the coil section 1 in a shower 9, and said welding coat 53 is removed. The flux which adhered in the solder process is washed in this washing process. The situation after the welding coat 53 was removed is shown in drawing 5 . Spacing G is the clearance produced by removal of the welding coat 53. As a penetrant remover, when a methylene chloride is used, washing for about 3 minutes is performed at about 40 degrees C of solution temperature.
[0028] The insulating material 3 between lines is formed by making the clearance G produced after removing a <line insulation resin spreading process>, next said welding coat 53 apply and harden liquefied thermosetting insulation resin. For example, as shown in drawing 6 , the pin 10 which carried liquefied thermosetting insulation resin 3 at the tip is pushed up in the direction of an arrow head a1, and liquefied thermosetting insulation resin 3 is applied to the front face of the coil section 1. After spreading finishes, a pin 10 is dropped in the direction of an arrow head b1. Drawing 7 shows the condition after doing in this way and applying liquefied heat-curing insulation resin.
[0029] Next, after spreading, it heat-treats and thermosetting insulation resin 3 is carried out sinking-in P1 to the coil section 1. Then, heat-curing processing of thermosetting insulation resin is performed, and the insulating material 3 between lines is formed. Drawing 8 shows the condition after ending heat-curing processing.
[0030] In the example using silicon acrylate insulation resin as thermosetting insulation resin, by the sinking-in process, heat treatment for heating temperature [of 100 degrees C] and heating time 20 seconds was performed, and after irradiating ultraviolet rays for 15 seconds, heat hardening processing for 10 minutes was performed at 150 degrees C at heat-curing down stream processing. The used silicon acrylate insulation resin is liquefied insulation resin of viscosity 250 mpa-S.
[0031] A <molding process>, next the sheathing object 4 which becomes by thermoplastic insulation resin about the whole are cast. For example, as shown in drawing 9 , after heat-curing processing of thermosetting insulation resin, the whole except parts for the point 62 and 72 of terminals 6 and 7 is wrapped in thermoplastic insulation resin, and the sheathing object 4 is cast.

The molding process conditions adopted in the example are as follows.
molding condition: -- injection molding injection-speed: -- 50 mm/s molding pressure force: -- 490kg/cm2 cylinder temperature: -- 360-degree-C die-temperature: -- 115-degree-C molding cycle-time: -- 10-second thermoplasticity insulation resin: -- liquid crystal polymer EC301B (Nippon Oil Co., Ltd. make)
As the above-mentioned process conditions see, the time amount which molding of thermoplastic insulation resin takes is the short time amount of 10 seconds.
[0032] At a thermoplastic insulation resin molding process, the stress which originates in the high molding-pressure force (490kg/cm2) and the molding temperature (360 degrees C) which were mentioned above, and is already generated where the insulating material 3 between lines which becomes by the electric conduction line 5 and thermosetting insulation resin is unified, since the clearance produced between the electric conduction lines 5 was filled with the insulating material 3 between lines which becomes by thermosetting insulation resin is opposed. for this reason, destruction of the insulating coat 52 to which the electric conduction line 5 adhered and a conductor -- deformation of a core wire 51 (refer to drawing 3), an open circuit, or a conductor -- the short circuit of a core wire 51 etc. can be prevented certainly. And since it unites with the insulating material 3 between lines which the electric conduction line 5 becomes by thermosetting insulation resin, the electric conduction line 5 does not move at the time of molding of the sheathing object 4. For this reason, the volume style of the coil section 1 is kept good, and the stable inductance value can be secured.
[0033] Finally, if terminals 6 and 7 are cut out from said leadframe 8, the electronic parts concerning this invention shown in drawing 1 can be manufactured.
[0034]
[Effect of the Invention] According to this invention, the following effectiveness can be acquired as stated above.
(a) The time amount which molding of a sheathing object takes can be shortened, and the electronic parts which raised productivity can be offered.
(b) destruction of the insulating coat to which the electric conduction line adhered, and a conductor -- deformation of a core wire, an open circuit, or a conductor -- the electronic parts of the high-reliability which can prevent accident, such as a short circuit of a core wire, certainly can be offered.
(c) The approach suitable for manufacturing the electronic parts which carried out (d) **** which can offer the electronic parts which can secure the stable inductance value can be offered.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the forward surface part part sectional view of the electronic parts concerning this invention.
[Drawing 2] In the manufacture approach concerning this invention, it is the forward surface part part sectional view of the electronic parts obtained after termination of a coil process and a process with a pewter.
[Drawing 3] It is the transverse-plane sectional view of an electric conduction line used for the manufacture approach concerning this invention.
[Drawing 4] It is the forward surface part part sectional view showing the washing process of the manufacture approach concerning this invention.
[Drawing 5] In the manufacture approach concerning this invention, it is the forward surface part part sectional view of the electronic parts obtained after washing process termination.
[Drawing 6] It is the forward surface part part sectional view showing the line insulation resin spreading process of the manufacture approach concerning this invention.
[Drawing 7] It is the forward surface part part sectional view showing the condition after applying liquefied heat-curing insulation resin.
[Drawing 8] In the manufacture approach concerning this invention, it is the forward surface part part sectional view of the electronic parts obtained after line insulation resin spreading process termination.
[Drawing 9] In the manufacture approach concerning this invention, it is the forward surface part part sectional view of the electronic parts obtained after molding process termination.
[Description of Notations]
1 Coil Section
2 Supporter Material
3 Insulating Material between Lines
4 Sheathing Object
5 Electric Conduction Line
51 Electric Conduction Core Wire
52 Insulating Coat
53 Welding Coat

[Translation done.]

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(71)出願人　000003067
ティーディーケイ株式会社
東京都中央区日本橋１丁目13番１号

(72)発明者　早川　隆範
東京都中央区日本橋１丁目13番１号　ティーディーケイ株式会社内

(72)発明者　岡崎　幸一郎
東京都中央区日本橋１丁目13番１号　ティーディーケイ株式会社内

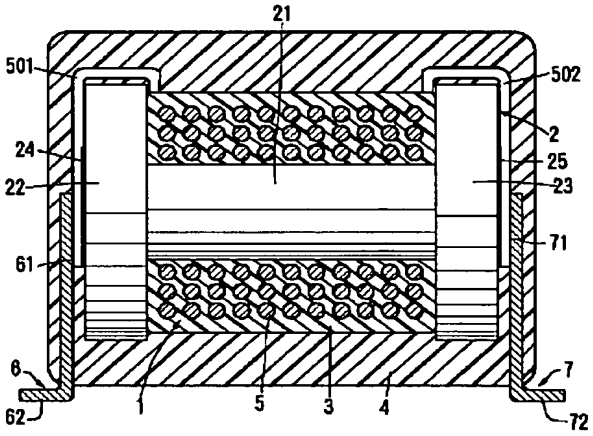
(74)代理人　弁理士　阿部　美次郎

(54)【発明の名称】　電子部品

(57)【要約】

【課題】　外装体成型に要する時間が短く、生産性が良好で、特性の安定した電子部品を提供する。

【解決手段】　巻線部１は、支持部材２に導電線５を巻装して構成される。線間絶縁物３は、熱硬化性樹脂でなり、導電線５の間に生じる隙間を埋めている。外装体４は、樹脂成型体でなり、全体を被覆している。



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【特許請求の範囲】
【請求項１】　巻線部と、支持部材と、線間絶縁物と、外装体とを含む電子部品であって、
前記巻線部は、前記支持部材に導電線を巻装して構成され、
前記線間絶縁物は、熱硬化性絶縁樹脂でなり、前記導電線の間に生じる隙間を埋めており、
前記外装体は、絶縁樹脂成型体でなり、全体を被覆している電子部品。
【請求項２】　請求項１に記載された電子部品であって、
前記外装体は、熱可塑性絶縁樹脂でなる電子部品。
【請求項３】　請求項１に記載された電子部品であって、
前記導電線は、導電芯線の周りに絶縁皮膜を有し、前記絶縁皮膜の上に、化学的処理によって除去可能な被覆を有する線材を出発線材としており、
前記線間絶縁物は、前記出発線材の前記被覆を除去した後に生じる隙間を埋めている電子部品。
【請求項４】　請求項３に記載された電子部品であって、
前記被覆は、ポリエステルでなる電子部品。
【請求項５】　請求項１に記載された電子部品であって、
前記支持部材は、磁性材料を含む電子部品。
【請求項６】　電子部品を製造する方法であって、
導電線を支持部材上に巻装し、その際、前記導電線として、導電芯線の周りに絶縁皮膜を有すると共に、前記絶縁皮膜の上に化学的処理によって除去可能な被覆を有するものを用い、
次に、化学的処理によって前記被覆を除去し、
次に、前記被覆を除去した後に生じる隙間に、熱硬化性絶縁樹脂を塗布し、含浸させ、硬化させ、
次に、全体を被覆する外装体を、絶縁樹脂を用いて成型する電子部品の製造方法。
【請求項７】　請求項６に記載された製造方法であって、
前記外装体は、熱可塑性絶縁樹脂を用いて成型する
【請求項８】　請求項６に記載された製造方法であって、
前記導電線の前記被覆は、ポリエステルでなる電子部品の製造方法。
【請求項９】　請求項６に記載された製造方法であって、
前記支持部材は、磁性材料を含む電子部品の製造方法。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、各種コイル装置、トランス等を含む電子部品及びその製造方法に関する。
【０００２】

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【従来の技術】従来のこの種の電子部品は、周知のように、例えばコアやボビン等の支持部材上に導電線を巻きつけ、全体を外装絶縁樹脂で被覆した構造をとるのが一般的である。導電線としては、銅線等でなる導電芯線の周りに絶縁皮膜を有し、絶縁皮膜の上に、融着被膜を設けた線材が知られている。かかる構成の導電線を用いた場合、外装絶縁樹脂としては、熱硬化性絶縁樹脂を用いる。また、導電線を巻き付けて構成した巻線部と、外装絶縁樹脂との間には、緩衝層となるアンダーコート層として、シリコン樹脂を塗布することも知られている。
【０００３】上述した従来の電子部品の問題点は、外装絶縁樹脂として、熱硬化性絶縁樹脂を用いているため、外装絶縁樹脂の成型に当たり、射出保持時間と、硬化時間に長時間を要し、生産性が上がらないことである。熱硬化性樹脂の成型に要する時間は、熱可塑性樹脂の成型に要する時間の約７倍程度にもなる。
【０００４】この問題を解決する手段として、外装絶縁樹脂を熱可塑性樹脂で構成することはこれまで検討されてきた。しかしながら、熱可塑性樹脂の成型温度は、例えば約３６０℃前後にもなる。これは、熱硬化性樹脂の成型温度が約８５℃前後であるのに対し、約２５０℃も高くなることを意味する。しかも、熱可塑性樹脂の成型圧力は、４９０kgf/cm^{2}にもなり、熱硬化性樹脂の成型に要する圧力２２kgf/cm^{2}の約２０倍にもなる。熱可塑性樹脂の高い成型温度及び成型圧力は、巻線部を構成する導電線に大きなストレスを与える。このストレスは、導電線に付着された絶縁皮膜の破壊、導体の変形もしくは断線、または導体間の短絡など、巻線部にきわめて深刻な影響を与える。また、高い成型圧力が加わると、導電線が過度に動き易い状態になるため、巻き姿態が変化し、インダクタンス値が変動する。
【０００５】従来、巻線部と外装絶縁体との間に、緩衝層となるアンダーコート層として、シリコン樹脂を塗布していたが、かかるアンダーコート層を有していても、外装絶縁樹脂として、熱可塑性樹脂を用いた場合、巻線部の保護に充分なストレス緩和作用を得ることができない。
【０００６】特に、導電線として、銅線等でなる導体の周りに絶縁皮膜を有し、絶縁皮膜の上に、融着被膜を設けた線材を用いた場合、熱可塑性絶縁樹脂を成型する際の高温度のために融着被膜が溶融し、その溶融状態に高い成型圧力が加わるという状態になるため、導電線に付着された絶縁皮膜の破壊、導体の変形もしくは断線または導体間の短絡等の事故をきわめて生じ易くなる。
【０００７】
【発明が解決しようとする課題】本発明の課題は、外装体成型に要する時間を短縮し、生産性を向上させた電子部品を提供することである。
【０００８】本発明のもう一つの課題は、電子部品に高い圧力や温度を加えても、導電線に付着された絶縁皮膜

の破壊、導体芯線の変形もしくは断線、または導体芯線間の短絡等の事故を確実に阻止し得る高信頼度の電子部品を提供することである。

【０００９】本発明の更にもう一つの課題は、安定したインダクタンス値を確保し得る電子部品を提供することである。

【００１０】

【課題を解決するための手段】上述した課題を解決するため、本発明に係る電子部品は、巻線部と、支持部材と、線間絶縁物と、外装体とを含む。前記巻線部は、前記支持部材に導電線を巻装して構成されている。前記線間絶縁物は、熱硬化性絶縁樹脂でなり、前記導電線の間に生じる隙間を埋めている。前記外装体は、全体を被覆する絶縁樹脂成型体でなる。

【００１１】本発明に係る電子部品は、巻線部が熱硬化性絶縁樹脂でなる線間絶縁物で覆われているから、巻線部及び熱硬化性絶縁樹脂が一体化された状態で、外部から加わるストレスに対抗する。このため、外装体として、熱可塑性絶縁樹脂を用いた場合でも、高温度及び高圧力の条件で行なわれる成型工程において、導電線に付着された絶縁皮膜の破壊、導体芯線の変形もしくは断線、または導体芯線の短絡などを、熱硬化性絶縁樹脂でなる線間絶縁物によって、確実に阻止することができる。そのため、電子部品全体を熱可塑性絶縁樹脂でなる外装体で被覆することができる。

【００１２】また、巻線部が熱硬化性絶縁樹脂で構成された線間絶縁物と一体化されるので、外装体の成型時に導電線が動くことがない。このため、巻き姿態を良好に保ち、安定したインダクタンス値を確保し得る。

【００１３】電子部品全体を熱可塑性絶縁樹脂でなる外装体で成型した場合、熱可塑性絶縁樹脂の成型に要する時間は、前述したように、熱硬化性絶縁樹脂の成型に要する時間よりも著しく短くなる。従って、外装体として、熱可塑性絶縁樹脂を用いることにより、熱硬化性絶縁樹脂を用いていた従来品に比較して、外装体の成型に要する時間を著しく短縮し、生産性を向上させることができる。熱可塑性絶縁樹脂としては、当該電子部品の使用温度を考慮し、それに充分に耐え得る溶融温度を有するものを使用する。

【００１４】上述した電子部品を製造するための本発明に係る製造方法は、次のようなプロセスをとる。まず、導電線を支持部材上に巻装する。このとき、前記導電線として、導電芯線の周りに絶縁皮膜を有すると共に、前記絶縁皮膜の上に化学的処理によって除去可能な被覆を有する線材を用いる。次に、化学的処理によって前記被覆を除去する。次に、前記被覆を除去した後に生じる隙間に、熱硬化性絶縁樹脂を塗布し、含浸させ、硬化させる。次に、全体を被覆する外装体を、絶縁樹脂を用いて成型する。この製造方法によれば、本発明に係る電子部品を容易に製造することができる。

【００１５】本発明の他の目的、手段及び利点は実施例たる添付図面を参照して、更に詳しく説明する。実施例は本発明の保護範囲について、何ら限定を伴うものではない。

【００１６】

【発明の実施の形態】図１は本発明に係る電子部品の部分断面図である。本発明に係る電子部品は、巻線部１と、支持部材２と、線間絶縁物３と、外装体４とを含む。巻線部１は、支持部材２に導電線５を巻装して構成される。支持部材２はコア、ボビンまたはそれらの組み合わせ等であり、任意の形状及び構造をとることができる。実施例に示す支持部材２はフェライト磁性材料等を用いて成型されたコアであり、中間部２１を細くし、その両端につば部２２、２３を設けたいわゆるドラム状の形状を有する。

【００１７】導電線５は、芯線となる導体を、絶縁皮膜によって被覆した構造のものが用いられる。絶縁皮膜の例としては、ポリウレタン等がある。導電線５の端末501、502は、端子６、７に半田付け等の手段によって接続されている。端子６、７は上部６１、７１が支持部材２のつば部２２、２３の外壁面に沿って配置されると共に、外装体４の内部に固定されている。端子６、７の下端部６２、７２は、外装体４の外部に導かれており、回路基板等に面実装された時の半田付け部分として用いられる。

【００１８】支持部材２のつば部２２、２３の側端面には、電極部２４、２５が形成されており、電極部分２４、２５に、導電線５の端末501、502及び端子６、７が半田付けされている。

【００１９】線間絶縁物３は、熱硬化性絶縁樹脂でなり、導電線５の間に生じる隙間を埋めている。線間絶縁物３を構成する熱硬化性絶縁樹脂の好ましい具体例としては、例えばシリコーンアクリレート絶縁樹脂を挙げることができる。導電線５の間に生じる隙間は、巻線工程において自然に発生する隙間の他、意図的に生じさせた隙間も含まれる。隙間を意図的に発生させる手段については、本発明に係る製造方法の実施例において、詳しく説明する。

【００２０】外装体４は熱可塑性絶縁樹脂でなり、全体を被覆している。外装体４を構成する熱可塑性絶縁樹脂の具体例としては、液晶ポリマーであるEC301B（日本石油株式会社製）を挙げることができる。この熱可塑性絶縁樹脂は、溶融温度が高く、耐熱性に優れている。

【００２１】上述したように、巻線部１が熱硬化性絶縁樹脂でなる線間絶縁物３で覆われているため、巻線部及び熱硬化性絶縁樹脂が一体化された状態で、外部から加わるストレスに対抗する。このため、外装体４として、熱可塑性絶縁樹脂を用いた場合でも、高温度及び高圧力の条件で行なわれる熱可塑性絶縁樹脂成型工程において、導電線５に付着された絶縁皮膜の破壊、導体芯線の

変形もしくは断線、または導体芯線の短絡などを、熱硬化性絶縁樹脂でなる線間絶縁物３によって、確実に阻止することができる。そのため、上述したように、電子部品全体を熱可塑性絶縁樹脂でなる外装体４で被覆することができるようになる。

【００２２】しかも、巻線部１が熱硬化性絶縁樹脂でなる線間絶縁物３と一体化されているから、外装体４の成型時に導電線５が動くことがない。このため、巻線部１の巻き姿態を良好に保ち、安定したインダクタンス値を確保し得る。

【００２３】更に、熱可塑性絶縁樹脂の成型に要する時間は、前述したように、熱硬化性絶縁樹脂の成型に要する時間の約1/7倍程度である。従って、外装体４として、熱可塑性絶縁樹脂を用いることにより、熱硬化性絶縁樹脂を用いていた従来品に比較して、外装体４の成型に要する時間を約1/7程度に短縮し、生産性を向上させることができる。

【００２４】次に、図２～図８を参照して、上述した電子部品を製造するための方法について説明する。

【００２５】＜巻線工程＞まず、図２に示すように、導電線５を支持部材２上に巻装する。導電線５としては、図３に示すように、導電芯線５１の周りに絶縁皮膜５２を有すると共に、絶縁皮膜５２の上に化学的処理によって除去可能な融着被膜５３を有する線材を用いる。絶縁皮膜５２の代表例はポリウレタンであり、融着被膜５３の代表例はポリエステルである。融着被膜５３は自己融着層と称されることがある。融着被膜５３は、化学的処理によって除去可能であればよいので、必ずしも、ポリエステルである必要はない。実施例では、次のような導電線５を用いた。

2CW-N4E（理研電線株式会社製）

線径：０．０３㎜

導電芯線５１：導線

絶縁皮膜５２：膜厚２μmのポリウレタン

融着被膜５３：膜厚２μmのポリエステル　溶融温度９０℃

【００２６】＜半田付け工程＞次に、図２において、リードフレーム８を切り起して形成された端子６－７間に、導電線５を巻装した支持部材２を搭載し、支持部材２のつば部２２、２３の側端面に形成された電極部２４、２５にクリームハンダを塗布し、電極部分２４、２５と、導電線５の端末501、502と、端子６、７とを、半田付けにより接続する。図示は省略されているが、前記リードフレーム８には、その長さ方向（紙面に対して垂直方向）に沿って、同様の端子６、７が間隔を隔て多数形成されている。

【００２７】＜洗浄工程＞次に、化学的処理によって前記融着被膜５３を除去する。例えば、図４に示すように、シャワー９で塩化メチレン等の洗浄液を巻線部１に浴びせ、前記融着被膜５３を除去する。この洗浄工程において、半田工程において付着したフラックス等も洗浄する。融着被膜５３が除去された後の様子を図５に示す。間隔Ｇが融着被膜５３の除去によって生じた隙間である。洗浄液として、塩化メチレンを用いた場合、液温約４０℃で、約３分間の洗浄を行なう。

【００２８】＜線間絶縁樹脂塗布工程＞次に、前記融着被膜５３を除去した後に生じる隙間Ｇに、液状熱硬化性絶縁樹脂を塗布し、硬化させることにより、線間絶縁物３を形成する。例えば、図６に示すように、先端に液状熱硬化性絶縁樹脂３を載せたピン１０を矢印ａ１の方向に押し上げて、巻線部１の表面に、液状熱硬化性絶縁樹脂３を塗布する。塗布が終わった後、ピン１０は矢印ｂ１の方向に降下させる。図７はこのようにして液状熱硬化絶縁樹脂を塗布した後の状態を示している。

【００２９】次に、塗布後に、加熱処理を行ない、巻線部１に対し、熱硬化性絶縁樹脂３を含浸Ｐ１させる。その後、熱硬化性絶縁樹脂の熱硬化処理を行ない、線間絶縁物３を形成する。図８は熱硬化処理を終了した後の状態を示している。

【００３０】熱硬化性絶縁樹脂として、シリコンアクリレート絶縁樹脂を用いた実施例において、含浸工程では、加熱温度１００℃、加熱時間２０秒の熱処理を行ない、熱硬化処理工程では、紫外線を15秒間照射した後、１５０℃で１０分間の加熱硬化処理を行なった。用いられたシリコンアクリレート絶縁樹脂は粘度２５０mpa･Sの液状絶縁樹脂である。

【００３１】＜成型工程＞次に、全体を熱可塑性絶縁樹脂でなる外装体４を成型する。例えば、図９に示すように、熱硬化性絶縁樹脂の熱硬化処理後に、端子６、７の先端部分６２、７２を除いた全体を熱可塑性絶縁樹脂で包み込んで、外装体４を成型する。実施例において採用された成型プロセス条件は次の通りである。

成型条件：インジェクション成型

射出速度：５０㎜/s

成型圧力：４９０kg/cm²

シリンダ温度：３６０℃

金型温度：１１５℃

成型サイクルタイム：１０秒

熱可塑性絶縁樹脂：液晶ポリマ　EC301B（日本石油株式会社製）

上記プロセス条件に見られるように、熱可塑性絶縁樹脂の成型に要する時間は１０秒という短い時間である。

【００３２】熱可塑性絶縁樹脂成型工程では、既に、導電線５の間に生じる隙間が、熱硬化性絶縁樹脂でなる線間絶縁物３で埋められているので、導電線５及び熱硬化性絶縁樹脂でなる線間絶縁物３が一体化された状態で、上述した高い成型圧力（４９０kg/cm²）及び成型温度（３６０℃）に起因して発生するストレスに対抗する。このため、導電線５に付着された絶縁皮膜５２の破壊、導体芯線５１（図３参照）の変形もしくは断線、または導体

芯線５１の短絡などを、確実に阻止することができる。しかも、導電線５が熱硬化性絶縁樹脂でなる線間絶縁物３と一体化されるので、外装体４の成型時に導電線５が動くことがない。このため、巻線部１の巻き姿態を良好に保ち、安定したインダクタンス値を確保し得る。

【００３３】最後に、端子６、７を前記リードフレーム８から切り取れば、図１に示す本発明に係る電子部品を製造できる。

【００３４】

【発明の効果】以上述べたように、本発明によれば、次のような効果を得ることができる。

（ａ）外装体の成型に要する時間を短縮し、生産性を向上させた電子部品を提供することができる。

（ｂ）導電線に付着された絶縁皮膜の破壊、導体芯線の変形もしくは断線または導体芯線の短絡等の事故を確実に阻止し得る高信頼度の電子部品を提供することができる。

（ｃ）安定したインダクタンス値を確保し得る電子部品を提供することができる

（ｄ）上述した電子部品を製造するのに適した方法を提供することができる。

【図面の簡単な説明】

【図１】本発明に係る電子部品の正面部分断面図である。

【図２】本発明に係る製造方法において、巻線工程及びハンダ付工程の終了後に得られる電子部品の正面部分断面図である。

【図３】本発明に係る製造方法に用いられる導電線の正面断面図である。

【図４】本発明に係る製造方法の洗浄工程を示す正面部分断面図である。

【図５】本発明に係る製造方法において、洗浄工程終了後に得られる電子部品の正面部分断面図である。

【図６】本発明に係る製造方法の線間絶縁樹脂塗布工程を示す正面部分断面図である。

【図７】液状熱硬化絶縁樹脂を塗布した後の状態を示す正面部分断面図である。

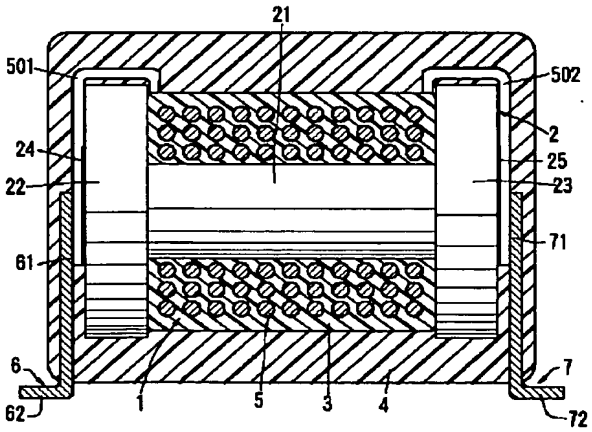
【図８】本発明に係る製造方法において、線間絶縁樹脂塗布工程終了後に得られる電子部品の正面部分断面図である。

【図９】本発明に係る製造方法において、成型工程終了後に得られる電子部品の正面部分断面図である。

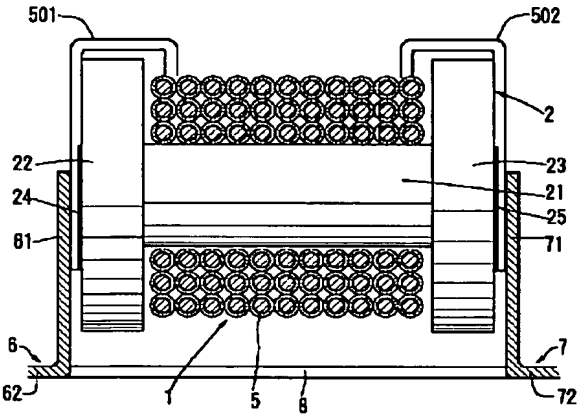
【符号の説明】

1	巻線部
2	支持部材
3	線間絶縁物
4	外装体
5	導電線
５１	導電芯線
５２	絶縁皮膜
５３	融着被膜

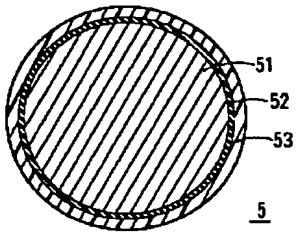
【図１】



【図２】



【図３】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52
53
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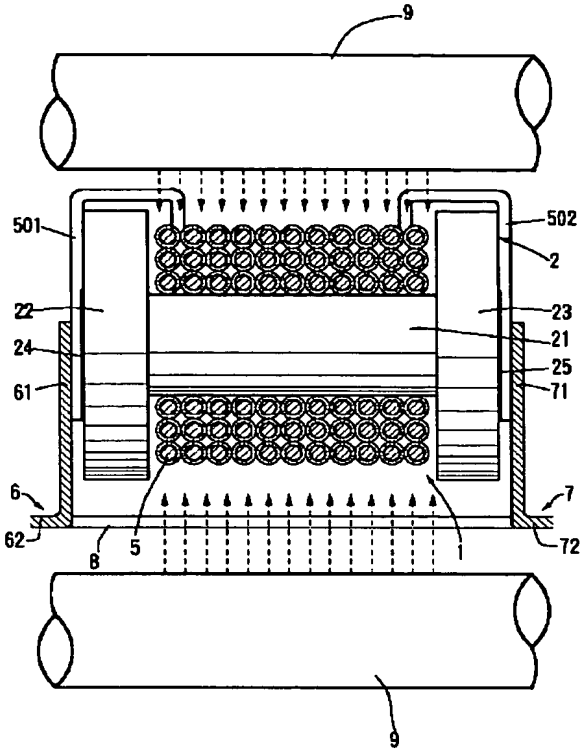
【図４】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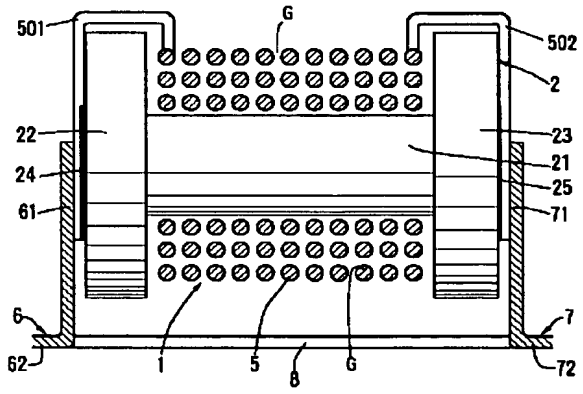
【図５】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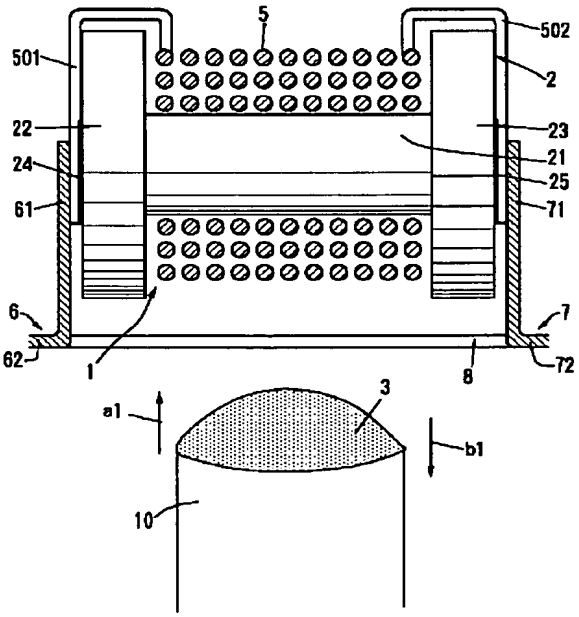
【図６】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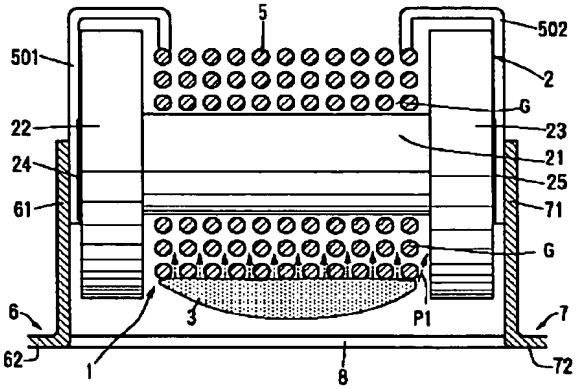
【図７】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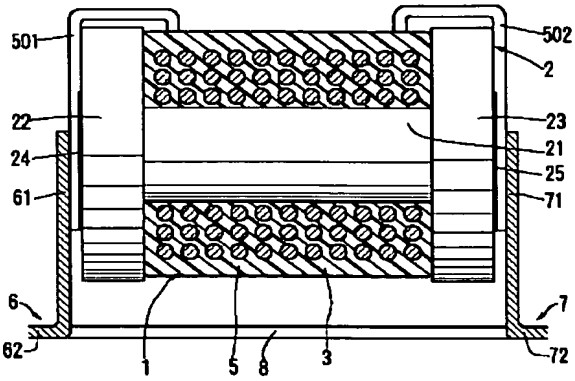
【図８】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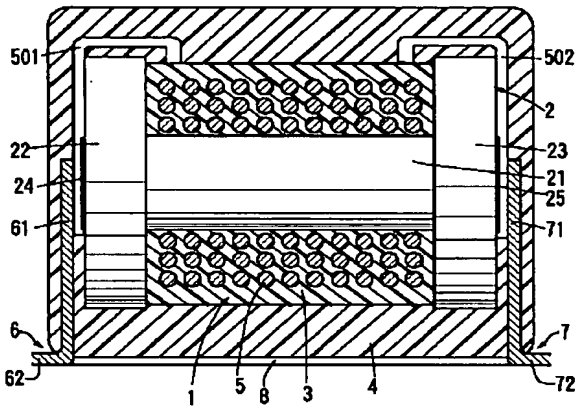
【図９】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